

### REMARKS

In response to the final office action dated May 27, 2008, Applicant added new claims 81 and 82. Claims 1-12, 14-18, 23-74, 81, and 82 are presented for examination.

#### Rejections under 35 U.S.C. §103(a)

The Examiner rejected claims 1-12, 14-18, 23-42, 53-62, and 64-69 under 35 U.S.C. §103(a) as being obvious over Scher et al. U.S. Patent 6,878,871 ("Scher") in view of Chirvase et al., Journal of Applied Physics, Vol. 93, No. 6, pages 3376-3383 ("Chirvase").

Claims 1-12, 14-18, 23-42, 53-62, and 64-69 require photovoltaic cells containing a mesh electrode and a photoactive layer containing a fullerene and a polymer. In the response filed on February 19, 2008, Applicant provided three reasons why one skilled in the art would not have wanted to combine Scher with Chirvase to provide the subject matter covered by claims 1-12, 14-18, 23-42, 53-62, and 64-69.

First, Applicant pointed out that one skilled in the art would not have wanted to replace the nanocrystals used in the photovoltaic cells described in Scher with the fullerene described in Chirvase at least because the result would have been a photovoltaic cell with a much lower efficiency than explicitly desired by Scher (i.e., more than 10%). Indeed, Chirvase teaches that the P3HT-fullerene photovoltaic cell described therein has an efficiency of only 0.2%. *See, e.g.,* the Abstract.

In response, the Examiner contended that "there is nothing in the claim about efficiency." *See* the final office action, page 11, last paragraph. Applicant would like to remind the Examiner that the argument above was presented to show that one skilled in the art would not have wanted to combine Scher with Chirvase. Thus, the issue of whether the pending claims recite efficiency is irrelevant to Applicants' argument. Rather, Applicants raise the issue of efficiency as evidence of the fact that it would not have been obvious to combine Scher and Chirvase in the manner indicated by the Examiner.

The Examiner also stated that

"Chirvase teaches a great motivation that 'conjugated polymer-fullerene (donor-acceptor) networks, also referred to as bulk heterojunctions, are a very promising approach for the improvement of efficiency of polymer solar cells' in second paragraph of second column of page 3376. Chirvase also concludes that the poor

efficiency in the test solar cell can be improved by a need for a homogenous mixture of a donor and acceptor ... Therefore, the poor efficiency shown in the test result of Chirvase is not because of the photoactive material of P3HT-fullerene, but because of other factors such as contamination or mixture ratio.” *See* the final office action, the paragraph bridging pages 11 and 12; emphasis added.

As discussed in Applicant's February 19, 2008 response, an object of Scher is to develop photovoltaic cells having an efficiency better than current inorganic photovoltaic cells, which generally have an efficiency of about 10%. In contrast, Chirvase's reference to “improvement of efficiency” is with respect to polymer solar cells. Further, as indicated above, even with the improvement, Chirvase's polymer solar cell only had an efficiency of 0.2%. Chirvase has not shown a polymer-fullerene photovoltaic cell that has an efficiency nearly close to 10%. Thus, even assuming that the Examiner's statements above are correct (which Applicant does not agree), one skilled in the art would still have not been motivated to replace the nanocrystals used in the photovoltaic cells described in Scher with the fullerene described in Chirvase because such a combination would not achieve the object of obtaining an efficiency higher than 10% in a photovoltaic cell set forth in Scher.

In other words, Chirvase's “improvement in efficiency” to provide the “great motivation” alleged by the Examiner if that “improvement in efficiency” is an improvement compared to 10%.

Second, Applicant pointed out in the February 19, 2008 response that one skilled in the art would not have wanted to substitute a fullerene described in Chirvase for the nanocrystals (which contain two inorganic materials) used in Scher because a fullerene by itself would not exhibit type II band offset energy profile.

The Examiner asserted that “any material in a photoactive region of a photovoltaic application (creating voltage from light) has ‘a type II band offset energy profile’ which includes the polymer matrix (See col. 14 lines 48-68).” *See* the final office action, page 12, lines 19-22; emphasis added.<sup>1</sup> Applicant disagrees. It is well known in the art that a type II band offset

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<sup>1</sup> It appears to be the Examiner's position that it is “common knowledge” that any material in a photoactive region of a photovoltaic cell has a type II band offset energy profile. Applicants would like to remind the Examiner that “[i]t is never appropriate to rely solely on ‘common knowledge’ in the art without evidentiary support in the record, as

energy profile is only exhibited in a heterojunction between p-type and n-type semiconductor materials, not by any material as asserted by the Examiner. In Scher, the type II band offset energy profile is exhibited by two inorganic materials. *See, e.g.*, column 7, lines 1-10. The polymer component described in Scher is optional (*see* Scher, column 17, lines 10-24) and therefore corresponds to the material in the hole carrier layer recited in claim 53, but not the polymer in a photoactive layer required by all rejected claims. Thus, replacing the nanocrystals used in Scher with a fullerene described in Chirvase would result in an article that does not exhibit type II band offset energy profile.

Finally, Applicant pointed out in the February 19, 2008 response that Scher teaches using nanocrystals in the photoactive layer to absorb light and generate excitons and that fullerene has only weak visible light absorption. Thus, one skilled in the art would not have wanted to replace the nanocrystals used in Scher with the fullerene described in Chirvase because the results would be photovoltaic cells that only have weak visible light absorption and therefore low efficiencies.

The Examiner asserted that “[a]s a matter of fact, Scher describes the light absorption and generation of excitons is in the photoactive region, more specifically at the junction of two different materials of different conductivities (hole conducting and electron conducting) in Figure 1 and col. 14 lines 59-63.” *See* the final office action, page 13, lines 5-8. Applicant disagrees. In the passage cited by the Examiner, Scher teaches that “[w]hen light (as indicated by arrow 112) impinges upon the nanocrystal component 104, it creates an exciton which passes a hole ( $\theta$ ) into the polymer matrix [106], and conducts the electron ( $e^-$ ) along the nanocrystal 104 ....” This passage clearly indicates that the incident light is absorbed by the nanocrystal. In addition, it is well known in the art that fullerene only has weak visible light absorption. Indeed, Figure 1 in Chirvase shows that incident light is absorbed by its electron donor (i.e., P3HT), not by its electron acceptor (i.e., fullerene). Thus, replacing the nanocrystals used in Scher with the fullerene described in Chirvase would result in photovoltaic cells that only have weak light absorption.

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the principal evidence upon which a rejection was based.” *See* MPEP 2144.03A; emphasis added. Thus, the Examiner is required to provide evidence to support his position stated in the cited passage if he intends maintain that position.

In sum, one skilled in the art would not have wanted to combine Scher with Chirvase to provide the photovoltaic cells required by claims 1-12, 14-18, 23-42, 53-62, and 64-69. Thus, claims 1-12, 14-18, 23-42, 53-62, and 64-69 are not obvious over Scher in view of Chirvase. Accordingly, Applicant request reconsideration and withdrawal of this rejection.

The Examiner rejected claims 43-52 and 70-74 under 35 U.S.C. §103(a) as being obvious over Scher in view of Chirvase and further in view of Chapin et al., U.S. Patent 2,780,765 ("Chapin"). The Examiner rejected claim 63 under 35 U.S.C. §103(a) as being obvious over Scher in view of Chirvase and further in view of Griffin, U.S. Patent 3,442,007 ("Griffin").

Claims 43-52, 63, and 70-74, as amended, require photovoltaic cells containing a mesh electrode and a photoactive layer including a fullerene and a polymer. As discussed above, one skilled in the art would not have wanted to combine Scher with Chirvase to provide such photovoltaic cells. Chapin describes a photovoltaic cell containing monocrystalline silicon with a p-n junction. *See*, e.g., claim 1 and column 2, lines 28-30. Griffin describes affixing a collector grid on the barrier of a cadmium sulfide solar cell. Similar to Scher, neither Chapin nor Griffin teaches or even suggests using a fullerene in a photovoltaic cell. Thus, one skilled in the art would not have combined Chapin or Criffin with Scher and Chirvase to provide the photovoltaic cells required by claims 43-52, 63, and 70-74. Even if these four references were combined, the results would not be the photovoltaic cells required by these claims. Accordingly, Applicant requests reconsideration and withdrawal of these two rejections.

#### Double patenting rejection

The Examiner provisionally rejected claims 1-12, 14-18, and 23-74 under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-39 of co-pending Application No. 11/033,217 in view of Scher. Applicant requests that this rejection be held in abeyance until the pending claims are otherwise in condition for allowance.

#### New claims

Applicant submits that new claims 81 and 82 are also patentable over the four cited references.

Specifically, new claims 81 and 82 cover photovoltaic cells that include a printed mesh electrode. Scher discloses photovoltaic cells having wire electrodes. See, e.g., column 31, lines 20-36. However, it does not disclose or render obvious photovoltaic cells having a printed mesh electrode, as required by new claims 81 and 82. Neither do the other three cited references. It would not have been obvious to combine the four cited references to provide the photovoltaic cells required by new claims 81 and 82. Even if these four references were combined, the results would not be the photovoltaic cells required by these two claims.

This reply is filed concurrently with a Request for Continued Examination. The required fee in the amount of \$810 is being paid concurrently herewith on the Electronic Filing System by way of Deposit Account authorization.

Please apply any other charges to deposit account 06-1050, referencing Attorney's Docket No. 15626-0006001.

Respectfully submitted,

Date: October 17, 2008

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